

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATORY
WASHINGTON, D.C. 20555

March 16, 1994

NRC INFORMATION NOTICE 94-19: EMERGENCY DIESEL GENERATOR VULNERABILITY TO
FAILURE FROM COLD FUEL OIL

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a safety problem that could lead to the common mode failure of all emergency diesel generator units as a result of temperature-related changes in the fuel oil. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

Vermont Yankee

During the electrical distribution safety functional inspection conducted from July 6 to August 7, 1992 (Inspection Report 50-271/92-81), the NRC team found that the Vermont Yankee emergency diesel generators may be vulnerable to excessive viscosity problems and the formation of wax crystals in cold fuel. The team expressed concern about the operability of the emergency diesel generators during those times when the actual outdoor temperature falls below the minimum temperature used in the procurement specification for the pour point of the oil. The pour point characteristic of the fuel oil is usually slightly lower than the cloud point characteristic. The cloud point is defined as the temperature at which a cloud of wax crystals appears in the fuel oil and begins to precipitate. When such a cloud appears, the capability to transfer the fuel oil from the storage tank to the emergency diesel generator engine cylinders might be degraded because of wax crystals clogging fuel oil filters and plating out on the walls of the fuel oil piping. This could result in the common mode failure of both emergency diesel generator units.

The licensee final safety analysis report specified a design outdoor temperature of -11°C [12°F]. The licensee technical specifications require compliance with American Society for Testing and Materials (ASTM) Standard D-975-68. This standard stipulates that for cold weather operation, the pour point of the emergency diesel generator fuel oil should be 6°C [10°F] below

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the ambient temperature at which the engine is to be operated except where fuel oil heating facilities are provided. The inspection team observed no heat tracing on the fuel oil storage tank, which is located outside, and that the heat tracing on the fuel oil transfer piping was not energized with a safety-related source of power. Therefore, on the basis of the design outdoor temperature, the pour point of the fuel oil should be no higher than -17°C [2°F]. The licensee procured fuel oil with a pour point of -18°C [0°F]. Consequently, the inspection team agreed that on the basis of the design outdoor temperature, the requirements of the licensee fuel oil procurement specification met those of the ASTM standard and hence those of the technical specification.

Even so, the inspection team questioned whether the licensee can assure the operability of the fuel oil transfer system and hence the emergency diesel generator because the licensee final safety analysis report noted that the minimum recorded outdoor temperature during a nine year observation period was -36°C [-33°F].

Point Beach

During the electrical distribution safety functional inspection from March 12 to April 6, 1990 (Inspection Report 50-266/90-201), the NRC team found a similar potential vulnerability of emergency diesel generators to excessive viscosity problems in cold fuel oil. A licensee calculation to determine the ability of the fuel oil to drain by gravity from the outside storage tanks to the day tanks indicated that under very low temperatures (-9°C [15°F]), no drainage would occur because the ambient temperature would be less than the cloud point of the fuel oil in the storage tanks and the above-ground piping. Moreover, the calculation showed that the minimum average temperature at which fuel could drain to one day tank was only -18°C [0°F]. The licensee tested the drainage for about 15 minutes in warm weather, but this did not demonstrate flow during extremely cold weather. The licensee now uses a fuel oil blend (No. 1 and No. 2) that corresponds to a cloud point of -24°C [-12°F]. In addition, in very cold weather, fuel oil in the bulk tanks is recirculated and the temperature is monitored. In extreme conditions, tank trucks are kept on site and parked in a heated warehouse as necessary.

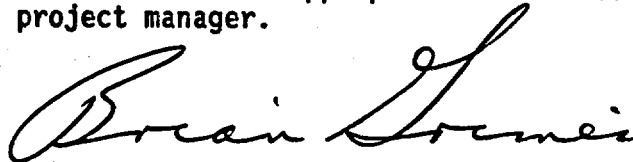
Discussion

Manufacturers of emergency diesel generators normally specify the type of fuel oil to be used in their engines and refer either to ASTM Standard D-975, Federal Specification VV-F-800, or their own detailed specifications. In either case, the heating, burning, physical, and chemical characteristics of the fuel are established to ensure proper operation of the emergency diesel generator units. These fuel oil specifications provide specific values for cloud point, pour point, and viscosity. Both the pour point and viscosity affect the capability of the fuel oil system to transfer fuel oil from a storage tank to the emergency diesel generator engine cylinders.

Unless licensees establish that stored emergency diesel generator fuel oil has the proper cloud, pour and viscosity characteristics, the common mode failure

of all emergency diesel generator units could occur. This is particularly true when fuel oil storage tanks and fuel transfer piping are outside and above ground where they are subject to large changes in ambient temperature. Emergency diesel generator fuel oil that is procured to specifications that do not properly establish the lowest expected temperature (cloud and pour point) requirements is especially susceptible. In conducting the routine 1-hour monthly surveillance runs or outage surveillance tests, the licensee may not operate the emergency diesel generator long enough to observe the effect of the cold fuel oil. Most of the fuel oil used during these tests will be from day tanks, which are at a higher temperature because they are located in the emergency diesel generator rooms. In contrast, an accident may require continuous operation of the emergency diesel generator for several days. The warmer fuel in the day tanks would be depleted. The emergency diesel generator would then be required to perform on fuel oil at a temperature that approximates the outside temperature. Improperly specified (procured) emergency diesel generator fuel oil for which the lowest expected use temperature is not taken into account could lead to a common mode failure of all the emergency diesel generator units.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.



Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: Gene Lazarowitz, RI
(215) 337-5392

Vern Hodge, NRR
(301) 504-1861

Attachment:
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-18	Accuracy of Motor-Operated Valve Diagnostic Equipment (Responses to Supplement 5 to Generic Letter 89-10)	03/16/94	All holders of OLs or CPs for nuclear power reactors.
94-17	Strontium-90 Eye Applicators: Submission of Quality Management Plan (QMP), Calibration, and Use	03/11/94	All U.S. Nuclear Regulatory Commission Medical Use Licensees.
94-16	Recent Incidents Resulting in Offsite Contamination	03/03/94	All U.S. Nuclear Regulatory Commission material and fuel cycle licensees.
94-15	Radiation Exposures during an Event Involving a Fixed Nuclear Gauge	03/02/94	All U.S. Nuclear Regulatory Commission licensees authorized to possess, use, manufacture, or distribute industrial nuclear gauges.
94-14	Failure to Implement Requirements for Biennial Medical Examinations and Notification to the NRC of Changes in Licensed Operator Medical Conditions	02/24/94	All holders of OLs or CPs for nuclear power and non-power reactors and all licensed reactor operators and senior reactor operators.
92-36, Supp. 1	Intersystem LOCA Outside Containment	02/22/94	All holders of OLs or CPs for nuclear power reactors.
94-13	Unanticipated and Unintended Movement of Fuel Assemblies and Other Components due to Improper Operation of Refueling Equipment	02/22/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

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This information notice was reviewed and commented upon by the Point Beach Project Manager on 01/24/94.

OFFICE	*OGCB:DORS:NRR	*EB:DRS:RI	*EB:DRS:RI	*EB:DRS:RI	*RPB:ADM
NAME	CVHodge	GLazarowitz	WHRuland	JDurr	Tech Ed
DATE	05/11/93	05/11/93	05/11/93	05/11/93	12/09/92
EMCB:DE:NRR*	EMCB:DE:NRR*	C/EMCB:DE:NRR	AD:DE:NRR	AC/OGCB:DORS:NRR	
KIParczewski	RAHermann	JStrosnider*	MWHodges*	AJKugler*	
02/15/94	02/15/94	02/18/94	02/18/94	02/23/94	

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requirements is especially susceptible. In conducting the routine 1-hour monthly surveillance runs or outage surveillance tests, the licensee may not operate the emergency diesel generator long enough to observe the effect of the cold fuel oil. Most of the fuel oil used during these tests will be from the day tanks, which are at the warmer emergency diesel generator room temperature. In contrast, an accident may require continuous operation of the emergency diesel generator for several days. The warmer fuel in the day tanks would be depleted. The emergency diesel generator would then be required to perform on fuel oil at a temperature that approximates the outside temperature. For plants in the northern and midwestern parts of the country, this could be about -30°C. Improperly specified (procured) emergency diesel generator fuel oil for which the lowest expected use temperature is not taken into account may lead to a common mode failure of all the emergency diesel generator units.

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